CLAIMS

1. A tubular metal body comprising a tube extruded through a porthole die and composed of a plurality of components joined to one another with a plurality of joint portions extending over the entire length of the tube, the base material metal of the extruded tube in each of the joint portions being subjected to a modifying treatment to produce finely divided crystal grains.

2. A tubular metal body according to claim 1 wherein the modifying treatment for the extruded tube is conducted by frictionally agitating each joint portion using a probe of a friction agitation joining tool.

3. A tubular metal body according to claim 1 wherein the extruded tube is fixedly provided inside thereof with a reinforcing partition extending longitudinally of the tube so as to divide inside of the extruded tube into a plurality of spaces.

4. A tubular metal body according to claim 3 wherein the reinforcing partition is joined to the extruded tube by friction agitation at at least two joint portions.

5. A tubular metal body according to claim 3 wherein the reinforcing partition is provided integrally with the components of the extruded tube.

6. A method of producing a tubular metal body characterized by preparing a tube extruded through a porthole die and comprising a plurality of components joined to one another with a plurality of joint portions extending over the entire length of the tube, placing a probe of a friction agitation

joining tool from outside into each of the joint portions of the extruded tube so as to position the probe partly in the tube components on opposite sides of the joint portion, and thereafter moving the extruded tube and the probe relative to each other longitudinally of the tube to thereby frictionally agitate the base material metal of the extruded tube for a modifying treatment to produce finely divided crystal grains.

7. A method of producing a tubular metal body according to claim 6 wherein the base material metal of the tube as extruded from an extruder is frictionally agitated in the joint portions immediately after extrusion.

8. A method of producing a tubular metal body according to claim 6 wherein the extruded tube has a reinforcing partition placed therein and extending longitudinally of the tube so as to divide inside thereof into a plurality of spaces, and in frictionally agitating the base material metal of the extruded tube in each of the joint portions thereof, a forward end of the probe is placed into the partition through each of at least two of the joint portions to join the partition to the extruded tube by friction agitation.

9. A method of producing a tubular metal body according to claim 6 wherein the extruded tube has a reinforcing partition interconnecting at least two of the components thereof and extending longitudinally of the tube, the reinforcing partition being extruded integrally with the tube.

10. A liner for pressure vessels which comprises a trunk having an opening at each of opposite ends thereof, and a head plate joined to each of the opposite ends of the trunk and

closing the end opening of the trunk, the trunk comprising the extruded tube having the modified joint portions and constituting the tubular metal body according to claim 1.

11. A liner for pressure vessels which comprises a trunk having an opening at each of opposite ends thereof, a head plate portion integral with one end of the trunk for closing the end opening of the trunk and having a mouthpiece mount portion, and a head plate joined to the other end of the trunk and closing the other end opening of the trunk, the trunk and the head plate portion being provided by machining one end portion of the extruded tube having the modified joint portions and constituting the tubular metal body according to claim 1.

12. A liner for pressure vessels according to claim 10 or 11 wherein the head plate is joined to the trunk by friction agitation.

13. A liner for pressure vessels according to claim 10 or 11 wherein the trunk is fixedly provided inside thereof with a reinforcing partition extending longitudinally of the trunk and dividing inside of the trunk into a plurality of spaces.

14. A liner for pressure vessels according to claim 13 wherein the reinforcing partition is joined to the trunk by friction agitation at at least two of the modified joint portions of the extruded tube constituting the trunk.

15. A liner for pressure vessels according to claim 13 wherein the reinforcing partition is extruded integrally with the components of the extruded tube constituting the trunk.

16. A liner for pressure vessels according to claim 13 wherein the reinforcing partition has an end portion positioned toward the trunk end to which the head plate is to be joined and projecting outward from the trunk, and the head plate is fitted around the projecting portion and joined to the trunk.

17. A liner for pressure vessels which comprises a trunk having an opening at each of opposite ends thereof and two head plate portions formed integrally with respective opposite ends of the trunk for closing the end openings and each having a mouthpiece mount portion, the trunk and the two head plate portions being provided by machining opposite end portions of the extruded tube having the modified joint portions and constituting the tubular metal body according to claim 1.

18. A liner for pressure vessels according to claim 10, 11 or 17 wherein the joint portions of the extruded tube constituting the trunk are modified by frictionally agitating each of the joint portions with a probe of a friction agitation joining tool.

19. A fuel cell system comprising a fuel hydrogen gas pressure vessel, a fuel cell and pressure piping for transporting fuel hydrogen gas from the pressure vessel to the fuel cell therethrough, the pressure vessel having a pressure vessel liner according to claim 10, 11 or 17.

20. A natural gas supply system comprising a natural gas pressure vessel, and pressure piping for delivering natural gas from the pressure vessel, the pressure vessel having a pressure vessel liner according to claim 10, 11 or 17.

21. A method of producing a liner for pressure vessels

characterized by preparing a tube extruded through a porthole die and comprising a plurality of components joined to one another with a plurality of joint portions extending over the entire length of the tube, placing a probe of a friction agitation joining tool from outside into each of the joint portions of the extruded tube so as to position the probe partly in the tube components on opposite sides of the joint portion, thereafter moving the extruded tube and the probe relative to each other longitudinally of the tube to thereby frictionally agitate the base material metal of the extruded tube for a modifying treatment to produce finely divided crystal grains and obtain a trunk having an opening at each of opposite ends thereof, and subsequently joining a head plate to each end of the trunk.

22. A method of producing a liner for pressure vessels characterized by preparing a tube extruded through a porthole die and comprising a plurality of components joined to one another with a plurality of joint portions extending over the entire length of the tube, placing a probe of a friction agitation joining tool from outside into each of the joint portions of the extruded tube so as to position the probe partly in the tube components on opposite sides of the joint portion, thereafter moving the extruded tube and the probe relative to each other longitudinally of the tube to thereby frictionally agitate the base material metal of the extruded tube for a modifying treatment to produce finely divided crystal grains and obtain a trunk having an opening at each of opposite ends thereof, subsequently forming a head plate portion having a

mouthpiece mount portion at one end portion of the trunk integrally therewith and further joining a head plate to the other end portion of the trunk.

23. A method of producing a liner for pressure vessels according to claim 21 or 22 wherein the base material metal of the tube as extruded from an extruder is frictionally agitated in each joint portion immediately after extrusion.

24. A method of producing a liner for pressure vessels according to claim 21 or 22 wherein the extruded tube has a reinforcing partition placed therein and extending longitudinally of the tube so as to divide inside thereof into a plurality of spaces, and in frictionally agitating the base material metal of the extruded tube in each of the joint portions thereof, a forward end of the probe is placed into the partition through each of at least two of the joint portions to join the partition to the extruded tube by friction agitation and to form the trunk and fix the partition to the trunk at the same time.

25. A method of producing a liner for pressure vessels according to claim 24 wherein the reinforcing partition has an end portion positioned toward the trunk end portion to which the head plate is to be joined and projecting outward from the trunk, and the head plate is fitted around the projecting portion and joined to the trunk.

26. A method of producing a liner for pressure vessels according to claim 21 or 22 wherein the extruded tube has a reinforcing partition interconnecting at least two of the components thereof and extending longitudinally of the tube,

the reinforcing partition being extruded integrally with the tube.

27. A method of producing a liner for pressure vessels according to claim 26 wherein the trunk end portion to which the head plate is to be joined is cut off to cause the reinforcing partition to project outward from the trunk, and the head plate is fitted around the projecting portion and joined to the trunk.

28. A method of producing a liner for pressure vessels according to claim 21 or 22 wherein the head plate is butted against the trunk end portion to which the head plate is to be joined, a probe of a friction agitation joining tool is then placed into the butted portion of the trunk and the head plate to position the probe partly in the trunk and the head plate, and the trunk and the head plate are thereafter moved relative to the probe to move the probe along the butted portion over the entire circumference thereof and join the head plate to the trunk by friction agitation.

29. A method of producing a liner for pressure vessels characterized by preparing a tube extruded through a porthole die and comprising a plurality of components joined to one another with a plurality of joint portions extending over the entire length of the tube, placing a probe of a friction agitation joining tool from outside into each of the joint portions of the extruded tube so as to position the probe partly in the tube components on opposite sides of the joint portion, thereafter moving the extruded tube and the probe relative to each other longitudinally of the tube to thereby frictionally agitate the base material metal of the extruded tube for a

modifying treatment to produce finely divided crystal grains and obtain a trunk having an opening at each of opposite ends thereof, and subsequently forming a head plate portion having a mouthpiece mount portion at each of opposite end portions of the trunk integrally therewith.